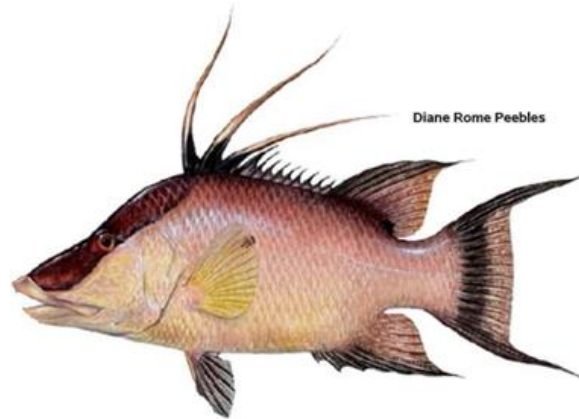


Hogfish Stock Definition, Status Determination Criteria, and Annual Catch Limit



Options Paper for an Amendment to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico

October 2015



This is a publication of the Gulf of Mexico Fishery Management Council Pursuant to National Oceanic and Atmospheric Administration Award No. NA15NMF4410011.

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CHAPTER 1. INTRODUCTION

1.1 Background

In 2004, a hogfish stock assessment (SEDAR 6) was prepared by the University of Miami under contract to the Florida Fish and Wildlife Conservation Commission (FWC). However, when it was submitted to a SEDAR review panel, several errors in the analyses were discovered, and the assessment was not accepted.

The 2015, FWC conducted a new benchmark assessment for hogfish (SEDAR 37). This assessment divided hogfish into three stocks based upon genetic analysis. The three stocks were defined as:

- West Florida stock.
- East Florida/ Florida Keys stock.
- Georgia through North Carolina stock

Although hogfish occur throughout the Gulf of Mexico (Gulf), they are caught primarily off the Florida coast. Only small amounts of commercial and recreational hogfish landings have been reported from the other Gulf states (SEDAR 37 2014). Therefore, the west Florida stock will be considered to be the Gulf of Mexico stock.

The assessment evaluated stock status as of 2012 relative to several reference points: F_{MSY} , $F_{30\% SPR}$, $F_{35\% SPR}$, and $F_{40\% SPR}$. The Gulf hogfish stock has a maximum fishing mortality threshold (MFMT) of $F_{30\% SPR}$, but the minimum stock size threshold (MSST) is currently undefined. SEDAR 37 determined the status of the three hogfish stocks as follows:

- West Florida shelf (Gulf) stock: Under all reference points the stock is not overfished. The stock is experiencing overfishing at the $F_{40\% SPR}$ reference point, but is not experiencing overfishing under the other reference points.
- East Florida/Florida Keys stock: Under all reference points, the stock is overfished and experiencing overfishing.
- Georgia-North Carolina stock: The stock is overfished under all of the reference points except the F_{MSY} point. Under all reference points, the stock is experiencing overfishing.

A small portion of the east Florida/Florida Keys stock extends into the Gulf Council's jurisdiction in south Florida, and will need to be included in the rebuilding plan that will be established by the South Atlantic Fishery Management Council. When the Scientific and Statistical Committee (SSC) reviewed the hogfish stock assessment, it felt that the South Atlantic SSC should take the lead in setting the overfishing limit (OFL) and acceptable biological catch (ABC) for that stock, and focused on the west Florida shelf stock. The assessment projections produced annual yields for OFL and ABC for the stock for 2016 through 2026 based on an overfishing threshold of $F_{30\% SPR}$, but due to increasing uncertainty with long-range projections, the SSC only provided OFL and ABC yields for three years, 2016 through 2018.

The OFL is the yield when the stock is fished at the F_{MSY} proxy, and is the yield beyond which overfishing is occurring, and is determined as part of the stock assessment output. However, there is always scientific uncertainty as to the true value of OFL. Consequently, ABC is a yield set below the OFL to take into account the scientific uncertainty. To determine the ABC yield, the SSC used the ABC control rule developed in the Generic Annual Catch Limits/Accountability Measures Amendment (GMFMC 2011). For the hogfish stock, the level for probability of overfishing (P^*) was set at 0.4 based on the results of the tier 1 analysis in the control rule, and a coefficient of variance (CV) of 0.37 was used based on the results of pooled assessments compiled by the Pacific Fishery Management Council for stocks in their jurisdiction. The resulting annual OFL and ABC yields plus the equilibrium yields are shown in Table 1.1:

Table 1.1.1. OFL and ABC for west Florida shelf stock of hogfish for 2016-2018, plus equilibrium yields

Year	OFL	ABC
2016	257,100 lbs ww	240,400 lbs ww
2017	229,400 lbs ww	216,800 lbs ww
2018	211,000 lbs ww	200,800 lbs ww
Equilibrium	161,900 lbs ww	159,261 lbs ww

Source: Summary report of the May 20, 2015 meeting of the SSC.

1.2 Purpose and Need

The purpose of this action is to consider redefining the geographic range of the Gulf of Mexico hogfish stock while allowing the East Florida/Florida Keys stock to be managed as a single unit throughout its range, setting status determination criteria (maximum fishing mortality threshold, minimum stock size threshold, and maximum sustainable yield proxy), annual catch limits, and annual catch targets based on a recent stock assessment (SEDAR 37) for the Gulf of Mexico hogfish stock.

The need is to establish a stock definition that is consistent with the best scientific information available, to prevent overfishing, and to adjust annual catch limits to be consistent with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act.

CHAPTER 2 - ACTIONS AND ALTERNATIVES

2.1 Action 1 – Definition of the Management Unit

Alternative 1: No Action – The hogfish management unit in the Reef Fish FMP remains defined as all hogfish found in the Gulf of Mexico north and west of the GMFMC/SAFMC jurisdictional boundary.

Alternative 2: South of Cape Sable. The hogfish management unit in the Reef Fish FMP is defined as the west Florida shelf (or Gulf of Mexico) stock of hogfish. The geographical range of this unit is all waters of the Gulf of Mexico north of a line extending west from **25° 09' north latitude** to the outer boundary of the EEZ and northward and westward throughout the rest of the Gulf of Mexico.

Alternative 3: Shark Point. The hogfish management unit in the Reef Fish FMP is defined as the west Florida shelf (or Gulf of Mexico) stock of hogfish. The geographical range of this unit is all waters of the Gulf of Mexico north of a line extending west from **25° 23' north latitude** to the outer boundary of the EEZ and northward and westward throughout the rest of the Gulf of Mexico.

Alternative 4: Monroe/Collier county line. The hogfish management unit is the west Florida shelf (or Gulf of Mexico) stock of hogfish. The geographical range of this unit is defined as all waters of the Gulf of Mexico north of a line extending west from **25° 48' north latitude** to the outer boundary of the EEZ and northward and westward throughout the rest of the Gulf of Mexico.

Note: Under **Alternative 2** or **Alternative 3**, the Council will request the Secretary of Commerce designate the South Atlantic Fishery Management Council as the responsible Council for hogfish below the demarcation line.

Discussion:

The Reef Fish FMP includes a list of stocks in the management unit, but currently it does not explicitly define the geographic range of the management unit for each stock. Rather, for each stock listed the management unit includes all individuals in the Gulf of Mexico. This implies that all of the individual fish are part of a single stock. However, the SEDAR 37 hogfish stock assessment (SEDAR 37 2014) identified three stocks based upon recent genetic analyses; Georgia/North Carolina, east Florida/Florida Keys, and west Florida shelf. The division between the west Florida shelf stock and the east Florida/Florida Keys stock occurs somewhere between Naples and the Florida Keys (Seyoum et al. 2014). The assessment used the Monroe/Collier county line, which is 21 nm south of Naples, as the dividing line between the west Florida shelf stock and the east Florida/Florida Keys stock. The assessment concluded that the west Florida shelf hogfish stock was neither overfished nor undergoing overfishing (except under the most conservative overfishing threshold of $F_{40\% SPR}$). The east Florida/Florida Key stock, however, was overfished and undergoing overfishing, and in need of a rebuilding plan.

Alternative 1 leaves the hogfish stock as all individuals in the Gulf of Mexico. The jurisdictional boundary between the Gulf and South Atlantic councils follows in part along 24° 35' north latitude. This is 73 nautical miles (nm) south of the Monroe/Collier county line, which was the demarcation used in the SEDAR 37 stock assessment between the west Florida and east Florida/Florida Keys stocks. This alternative continues the implicit assumption that all hogfish in the Gulf are part of a single stock. This is inconsistent with the SEDAR 37 (2014) stock assessment, which determined that there are two hogfish stocks off the coast of Florida, with a dividing line south of Naples. While the west Florida shelf hogfish stock was found to be neither overfished nor undergoing overfishing (except under the most conservative overfishing threshold), the east Florida/Florida Keys stock was found to be both overfished and undergoing overfishing. This will require different management strategies and a rebuilding plan for those hogfish that comprise the east Florida/Florida Keys stock.

Alternatives 2, 3, and 4 define a boundary off southwest Florida below which the Gulf of Mexico stock is undefined. Hogfish in this region will not be part of the Reef fish fishery management unit, and will not be subject to management under the Reef Fish FMP. It is the intent of the Council that under **Alternatives 2, 3, and 4**, the Council will request the Secretary of Commerce to designate the South Atlantic Fishery Management Council as the responsible Council for hogfish below the demarcation line.

Alternative 2 defines the boundary for the hogfish management unit in the Gulf of Mexico off Florida at 25° 09' north latitude, which is just south of Cape Sable on the west coast of Florida. It is 38 nm south of the Monroe/Collier county line. This line is currently used by the Florida Fish and Wildlife Conservation Commission (FWC) as a regulatory boundary for state managed species such as permit. It is also considered by FWC to be far enough north of the Keys and far enough south of Naples and Marco Island so that regulatory issues are not simply shifted north to Collier County. However, this creates a discontinuity with the SEDAR 37 stock assessment, which used the Monroe/Collier county line as the demarcation between hogfish stocks. The further south from the Monroe/Collier county line the boundary is set, the greater the discontinuity between the assessment and management, and the greater the likelihood that part of the east Florida/Florida Keys stock will be under Gulf Council jurisdiction rather than South Atlantic Council.

Alternative 3 defines the boundary for the hogfish management unit in the Gulf of Mexico off Florida at 25° 23' north latitude, which corresponds to the Shark Point reference point in the Everglades on the west coast of Florida. It is 25 nm south of the Monroe/Collier county line. According to information provided by Council members, fishing trips originating south of this boundary rarely travel north of the boundary, and trip originating north of the boundary rarely travel south. Therefore, this boundary serves as a natural demarcation for fishermen, although there is some discontinuity with the stock assessment boundary. As with the previous alternative, this boundary creates a discontinuity with the SEDAR 37 stock assessment, which used the Monroe/Collier county line as the demarcation between hogfish stocks. However, the discontinuity is not as great (25 nm vs. 38 nm).

Alternative 4 defines the boundary for the hogfish management unit in the Gulf of Mexico off the Monroe/Collier County line, which is consistent with the boundary used by the SEDAR 37

(2014) stock assessment. Commercial ALS, Florida trip ticket, MRFSS, and MRIP landings can all be resolved to the county level, allowing landings reports to be consistent with the stock boundary.

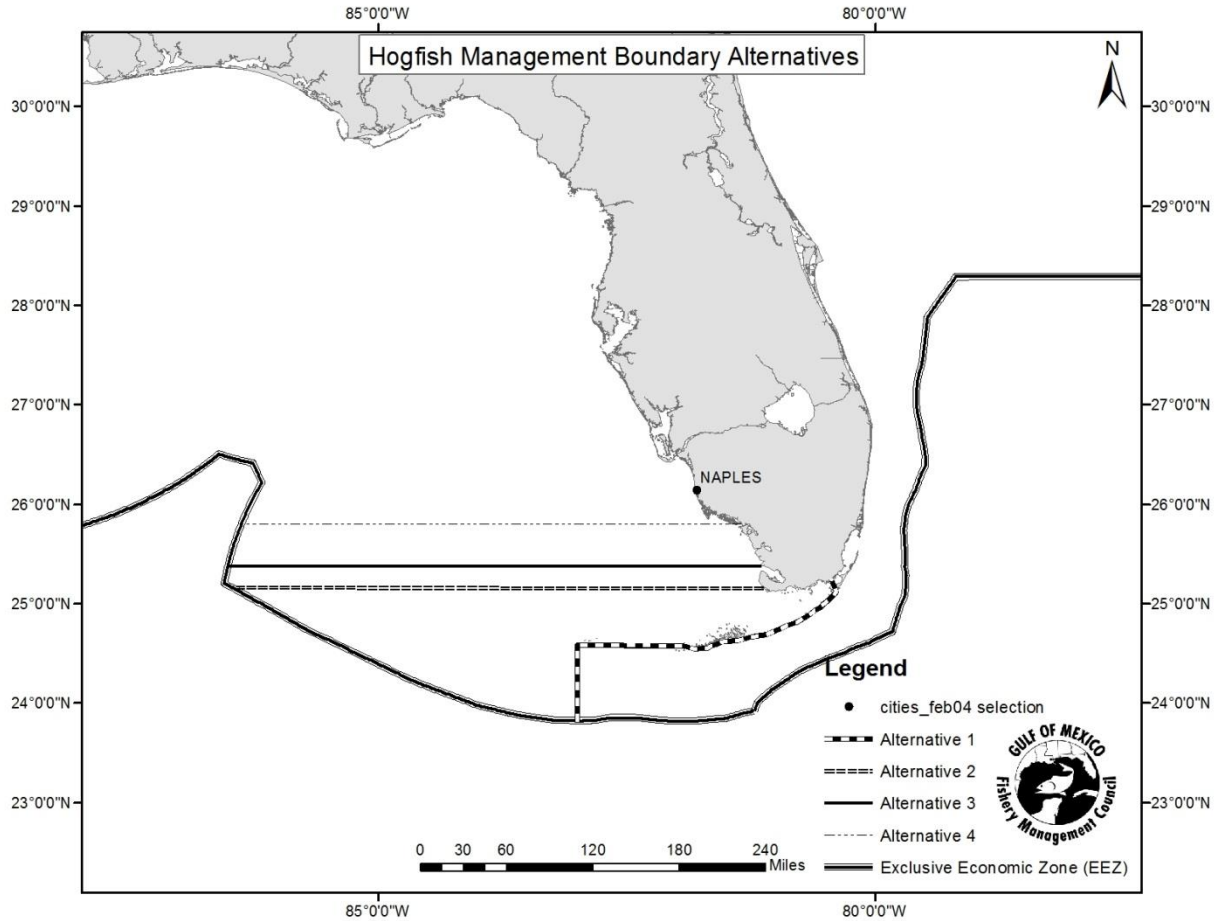


Figure 2.2.1. Hogfish management boundary alternatives

2.2 Action 2 – Define Status Determination Criteria for Hogfish

Alternative 1: No Action – MSY is undefined, MSST is undefined, and MFMT = $F_{30\% SPR}$.

Alternative 2: MSY = the point estimate of MSY in the most recent stock assessment.

MFMT = F_{MSY} in the most recent stock assessment

MSST =

Option a: $(1-M)*SSB_{MSY}$, where $M = 0.179$

Option b: $0.75*SSB_{MSY}$

Option c: $0.50*SSB_{MSY}$

Alternative 3: MSY = equilibrium yield at $F_{30\% SPR}$

MFMT = $F_{30\% SPR}$

MSST =

Option a: $(1-M)*SSB_{30\% SPR}$, where $M = 0.179$

Option b: $0.75*SSB_{30\% SPR}$

Option c: $0.50*SSB_{30\% SPR}$

Alternative 4: MSY = equilibrium yield at $F_{40\% SPR}$

MFMT = $F_{40\% SPR}$

MSST =

Option a: $(1-M)*SSB_{40\% SPR}$, where $M = 0.179$

Option b: $0.75*SSB_{40\% SPR}$

Option c: $0.50*SSB_{40\% SPR}$

Discussion:

The formula will be the controlling factor for defining the status determination criteria. The point values may change if a new stock assessment provides additional information, but as of SEDAR 37, the point values for each of the above alternatives are shown in Table 2.2.1.

Table 2.2.1 Status determination criteria values for several MSY proxies.

	Alt. 1 Proxy undef.	Alt. 2 Model MSY	Alt. 3 30% SPR	Alt. 4 40% SPR
MSY (1000 lb ww)	n/a	169	162	146
MFMT	0.095	0.150	0.095	0.062
MSST (1000 lb ww)	n/a	844	1,299	1,809

Source: SEDAR 37, Table 11.2.7.1.1. MSY for Alternatives 3, and 4, Dustin Addis, pers. comm.

MSY is defined in the National Standard Guidelines as the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets. MSY can usually be calculated within a stock assessment, but a confident estimate requires a strong stock-recruit relationship. If the spawner-recruit relationship is weak or uncertain, which is often the case, then a proxy can be used.

Alternative 1 leaves MSY and MSST undefined. MFMT was defined under the Sustainable Fisheries Act Generic Amendment (GMFMC 1999). These status determination criteria are required under the National Standard 1 guidelines for each stock being managed. If left undefined in this amendment, these criteria can be defined in the Minimum Stock Size Threshold Amendment which is currently under development.

Alternative 2 uses the model generated estimate of MSY. This produces the highest yield levels but at the lowest level of spawning stock biomass. The SEDAR 37 assessment did not make a recommendation as to whether the stock-recruit relationship was strong enough to use the estimated MSY. However, the assessment noted that the model produced relatively stable SSB levels predicted throughout the model period. This lack of contrast in stock-recruit data additionally led to a relatively flat likelihood profile for steepness in this stock and the sensitivity run where the steepness prior was removed led steepness to be estimated near the upper bounds of $h=0.9999$. Under these conditions there is essentially no discernable relationship between stock and recruitment, and an MSY proxy is generally used.

Alternative 3 sets the MSY proxy at conservative level of the yield at 30% SPR. This is the proxy used with most stocks, and with the current maximum fishing mortality threshold (MFMT) for hogfish. Hogfish currently have a maximum fishing mortality threshold of $F_{30\% SPR}$, which was set in 1999 under the Generic Sustainable Fisheries Act Amendment (GMFMC 1999). However the minimum stock size threshold (MSST) and a MSY proxy proposed in that amendment were rejected by NMFS and are currently undefined. The SSC usually recommends MSY proxies in the 30% to 40% SPR range. This alternative would make the MSY proxy and MSST consistent with the MFMT.

Alternative 4 sets the MSY proxy at conservative level of the yield at 40% SPR. This is at the upper end of the range of SPR proxies recommended by the SSC, but is more commonly used as a proxy for optimum yield than for MSY. If this alternative is adopted, then based on the SEDAR 37 stock assessment, the current fishing mortality rate for hogfish exceeds $F_{40\% SPR}$, and the stock is therefore experiencing overfishing. The SSC would need to reevaluate its ABC recommendation, and the Council would likely be required to take action to end overfishing.

Under **Alternatives 2, 3, and 4**, three options are provided for determining MSST.

Option a sets MSST at $(1-M)$ times the SSB_{MSY} or proxy. For hogfish, the SEDAR 37 assessment used a natural mortality rate that varied with age, but with a cumulative target $M=0.179$. Therefore, option a sets MSST at 82% of the SSB_{MSY} or proxy. **Option b** sets MSST at 75% of the SSB_{MSY} or proxy. **Option c** sets MSST at 50% of the SSB_{MSY} or proxy, which is the lowest level allowed under the Magnuson-Stevens Act and National Standard Guidelines.

Setting MSST close to SSB_{MSY} or proxy, as in **Option a**, allows a stock to be declared overfished and put under a rebuilding plan at an early stage of its decline. However, it may also result in spurious overfishing determinations due to natural year-to-year fluctuations in stock biomass. A wider buffer such as **Option c** allows greater management flexibility to reverse a decline before the stock becomes overfished, but if the stock does fall below MSST, it will have a greater amount to rebuild and may require a more restrictive rebuilding plan. **Option b** is an intermediate level that provides some additional flexibility but still results in an overfishing determination at a level that's more conservative than **Option c**.

The Council is working on a separate amendment to define MSST for all stocks. The MSST options in this action mirror those in the MSST amendment.

2.3 Action 3 – Annual Catch Limit for Hogfish

Alternative 1: No Action. ACL = 208,000 lbs ww, and ACT = 179,000 lbs. ww

Alternative 2: ACL equals the ABC for each year 2016-2018. The ACL for years following 2018 will then revert to the equilibrium ABC yield until modified by rulemaking.

2016 ACL = 240,400 lbs ww
2017 ACL = 216,800 lbs ww
2018 ACL = 200,800 lbs ww
2019+ ACL = 159,300 lbs ww

Option a: ACT will not be defined

Option b: ACT will be set based on the ACL/ACT control rule at 87% of the ACL:
2016 ACT = 209,100 lbs ww
2017 ACT = 188,600 lbs ww
2018 ACT = 174,700 lbs ww
2019+ ACT = 138,600 lbs ww

Alternative 3: A constant catch ACL is set at xxx based on the constant catch ABC recommendation for the years 2016-2018 of the SSC. The ACL for years following 2018 will then revert to the equilibrium ABC yield of 159,300 lbs ww until modified by rulemaking.

Option a: ACT will not be defined

Option b: ACT will be set based on the ACL/ACT control rule at 87% of the ACL: xxx for the years 2016-2018. The ACL for years following 2018 will then revert to the equilibrium ABC yield of 138,600 lbs ww until modified by rulemaking.

Alternative 4: A constant catch ACL is set at the equilibrium ABC level of 159,300 lbs ww. This ACL will remain in place in subsequent years until modified by rulemaking.

Option a: ACT will not be defined

Option b: ACT will be set based on the ACL/ACT control rule at 87% of the ACL: 138,600 lbs ww. This ACT will remain in place in subsequent years until modified by rulemaking.

Discussion:

Under **Alternative 1**, the hogfish ACL and ACT will remain at the levels established in 2012 under the Generic Annual Catch Limits/Accountability Measures Amendment. These catch levels were set using ABC control rule tier 3a, a data poor method. The mean catch from 1999-2008 was calculated (mean = 143,500 lbs ww, range – 84,500-288,600 lbs ww) and a standard deviation was calculated. The ACT was set at the mean plus one standard deviation (179,000 lbs ww) and the ACL was set at the mean plus two standard deviations (272,000 lbs ww). This allowed the stock some leeway to fluctuate above the mean landings. However, the landings exceeded the ACL in 2012 and 2013, triggering a season closure on both recreational and commercial fishing in 2013 (Table 2.3.1).

Table 2.3.1. Hogfish landings relative to ACL and closing date, 2012-2014. Landings are in lbs ww.

Year	Recreational Landings	Commercial Landings	Total Landings	ACL	Percent of ACL	Season Closing Date
2014	159,982	35,930	195,912	208,000	94%	
2013	217,759	24,787	242,546	208,000	117%	12/2/13
2012	250,128	42,989	293,117	208,000	141%	n/a

Source: NMFS Southeast Regional Office

Alternative 2 sets an annual ABC for each year from 2016 through 2018 based on the annual yield projections recommended by the SSC when fishing at a constant fishing mortality rate. The overfishing limit (OFL) was set at the yield when fishing at a fishing mortality rate of $F_{30\% SPR}$, and the ABC was set a level below OFL to reduce the probability of overfishing to 40* ($P^* = 0.40$). The ACL is set at ABC. If the Council chooses to set an MFMT other than $F_{40\% SPR}$, the SSC will need to reevaluate its ABC recommendation. The stock spawning stock biomass is currently above its maximum sustainable yield (MSY) level, so this rate of fishing is projected to gradually reduce the stock to slightly above its MSY level. If there is no new stock assessment by 2018 (no assessment is currently planned), the ABC and ACL will revert to the equilibrium ABC level of 159,300 lbs ww. This is because, although the SSC recommended only three years of ABCs, the projected yield trend continues downward for several years (Figure 2.3.1). Maintaining the 2018 ABC and ACL indefinitely in the absence of a new assessment would likely result in overfishing. For that reason, the SSC recommended at its September 2015 meeting that, if at the end of an ABC projection period, no new assessment is available, and the equilibrium ABC is below the ABCs for the projected period, ABC should revert to the equilibrium ABC.

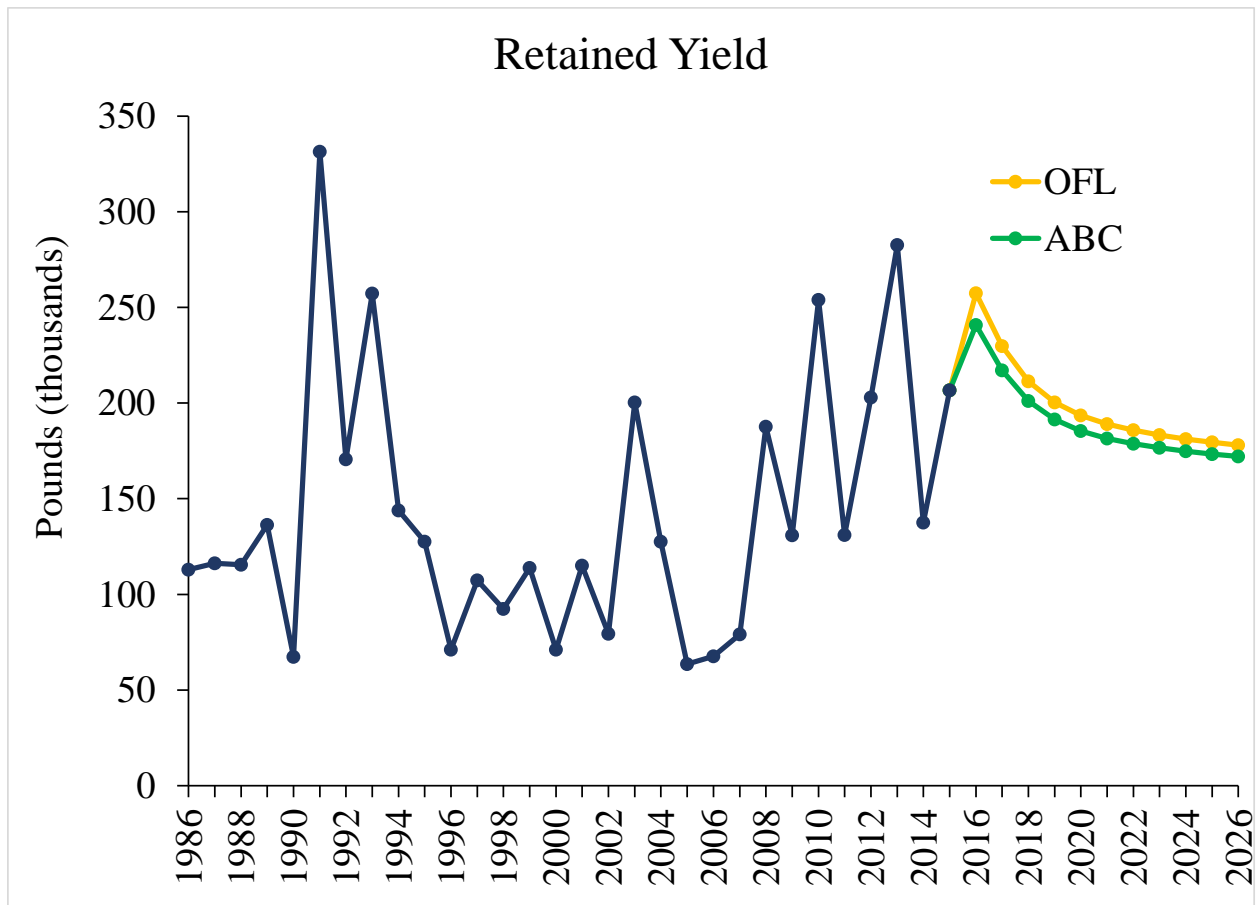


Figure 2.3.2. West Florida shelf hogfish stock OFL and ABC yield trends

The ACT, if set, is at 87% of the ACL based on the ACL/ACT control rule. **Option a** would not set the ACT, while **Option b** would set the ACT. The accountability measure for hogfish (which is the default accountability measure for most reef fish) states that, if the ACL is exceeded in a given year, the following year the season will be closed when the ACL is projected to be reached. There are no actions or accountability measures related to the ACT for hogfish. Therefore, the ACT for hogfish serves no functional purpose.

Alternative 3 sets a constant catch ACL for a specified number of years based on an alternative constant catch ABC recommended by the SSC. This ABC has the same conservation equivalency as the constant F ABC yield stream in **Alternative 2**. As with **Alternative 2**, if there is no new stock assessment by 2018 (no assessment is currently planned), the ABC and ACL will revert to the equilibrium ABC level of 159,300 lbs ww. **Option a** and **Option b** regarding the ACT are the same as described for Alternative 1. The Council requested that the SSC provide a constant catch ABC at its August meeting. In September, the SSC agreed on a process for determining the constant catch ABC. The results of that process will be available at the January 2016 SSC meeting.

Alternative 4 sets a constant catch ACL at the equilibrium ABC of 159,300 lbs ww. This is the level at which the yield is projected to remain constant without further declines in the stock level

if fished over a long period of time. Overfishing is unlikely to occur at this level, and future adjustments to the ACL should theoretically be unnecessary. However, due to uncertainties in the data and likely fluctuations in recruitment which cannot be predicted, a new assessment should still be conducted periodically and the equilibrium ABC recalculated.

Option a and **Option b** regarding the ACT are the same as described for the above alternatives.

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